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New Facility to Improve Airborne Telescope's Clarity

A NASA airborne observatory's images of space will be sharper and more precise, thanks to a new mirror coating facility being installed at the agency's Ames Research Center, Moffett Field, CA.

Constructed of stainless steel, the mirror coating facility resembles a huge pressure cooker. It measures approximately 4.3 meters (14 feet) in diameter, stands about 4.9 meters (16 feet) high, and weighs 10 metric tons (22,000 pounds). Scientists will use it periodically to recoat the 2.7-meter (106.3-inch) diameter telescope's primary mirror in NASA's Stratospheric Observatory For Infrared Astronomy (SOFIA). Installation of the new coating facility in the SOFIA Mission and Operations Center at Ames, located in the heart of California's Silicon Valley, will take several weeks. The coating facility supplier is Chart, Inc., Westborough, MA.

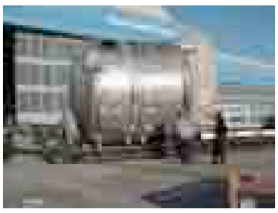
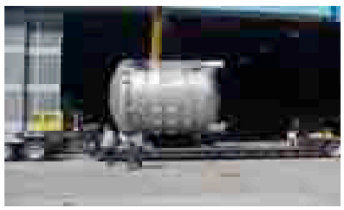
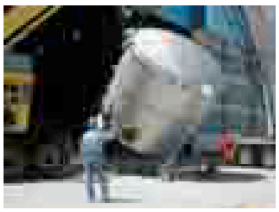
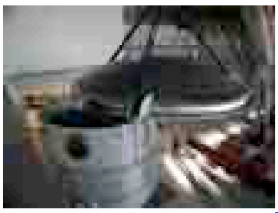
"We're very pleased that this critical, unique element of SOFIA's ground support system has arrived here at Ames," said SOFIA Project Manager Chris Wiltsee. "This facility will play a major role in the future missions of SOFIA."

Scientists require SOFIA's sophisticated telescope be kept immaculately clean in order to ensure accurate astronomical observations. "Once a year, we will use the mirror coating facility to replace the high-precision coating on the telescope's mirror," explained Eric Becklin, chief scientist with Universities Space Research Association (USRA), NASA's prime contractor for the SOFIA project. As needed, the

top of the stainless steel vacuum chamber will be lifted off and SOFIA's mirror will be lowered into the chamber, where it will receive a delicate coating of aluminum that is about one 300th the thickness of a human hair. The total amount of aluminum that will coat the 60-square foot mirror surface is roughly equivalent to the quantity of aluminum that may be found in about one fourth of an average soda can.

The coating process involves vaporizing aluminum. Inside the facility's chamber is a filament array system containing more than 60 tungsten filaments. These are similar to the filaments inside many light bulbs, but much larger, and are connected to a high-current, low-voltage power supply. Before beginning the coating process, the old coating on the mirror is chemically stripped away and the bare glass is thoroughly cleaned. A worker enters the chamber and hangs several strips of very pure aluminum on each filament.

Images of SOFIA mirror coating facility being moved into hanger 211, Ames Research Center.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The mirror assembly is then lowered into the chamber and everything but the mirror's front surface is shielded with special materials. After the top is reinstalled, powerful pumps remove air from the chamber to create a near vacuum. Next, the filaments are electrified, and the resulting heat generated within them vaporizes the aluminum. The vaporized aluminum then adheres to the unshielded mirror's surface, thereby providing it with a thin aluminum coating. To minimize the build-up of dust on the mirror surface that could damage the coating or otherwise degrade scientific performance, scientists also will use pressurized carbon dioxide gas to clean the mirror once a week. A special wand-shaped nozzle condenses the gas into "snow" as it flows onto the mirror.

"Using the wand, the spray is directed across the surface of the mirror at a glancing angle," explained Patrick Waddell, USRA's associate director of the SOFIA Mission and Support Group. "The carbon dioxide snowflakes carry the dust away." Although this dramatically slows down the need for coating, the mirror will continue to degrade, according to Waddell. To further help keep it clean, workers periodically will also gently wash the telescope's mirror with a water-based liquid.

SOFIA's astronomical observations will be conducted at an altitude of about 41,000 feet aboard a modified Boeing 747SP aircraft operated and maintained by United Airlines. While using airborne telescopes is not new, SOFIA will be the world's largest and most powerful, considerably larger and

more sophisticated than its predecessor, the Kuiper Airborne Observatory that was based at Ames from 1971 to 1995.

NASA awarded a $484.2 million contract to Universities Space Research Association, Columbia, MD, in December 1996, to acquire, develop and operate SOFIA. Other team members include Raytheon Aircraft Integration Systems, Waco, TX; United Airlines, San Francisco; the University of California, Los Angeles, Berkeley and Santa Cruz, CA; the Astronomical Society of the Pacific, San Francisco; the SETI Institute, Mountain View, CA; and Sterling Federal Systems, Redwood City, CA. SOFIA's complex telescope is being developed by DLR, the German Aerospace Center, located in Bonn. The specifications for the mirror coating facility were developed by NASA Ames with assistance from USRA and the University of California Observatories in Santa Cruz, CA.

Annual operating costs of SOFIA are anticipated to be about $40 million. SOFIA's first test flight is currently scheduled in October 2003 at Raytheon's Waco, TX, flight facility. SOFIA is scheduled to arrive at Ames in May 2004 for final testing preparatory to full-scale operations starting in late 2004. Further information about SOFIA is available on the SOFIA web site, located at: http://sofia.arc.nasa.gov

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